

NJ ASPHALT PAVING CONFERENCE 2022

LOCAL AID SPECIFICATION-IRI BEST PRACTICES FOR RIDEABILITY

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Acknowledgement

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Outline

- ❖ **Background**
- ❖ **Specification**
- ❖ **Quality Assurance Testing**
- ❖ **Construction**

Background



Ride Quality – Where it comes from?

❖ International Road Roughness Experiment, 1982

Sponsored by World Bank

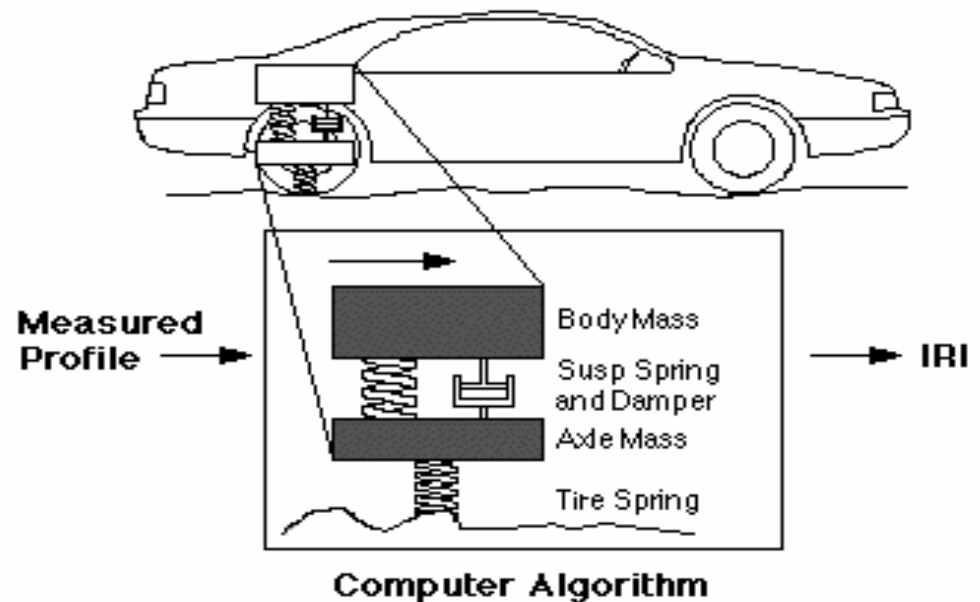
❖ International Roughness Index (IRI)

❖ **PAVEMENT SMOOTHNESS = DRIVER COMFORT**

VEHICLE RESPONSE

HUMAN RESPONSE TO

VIBRATION



International Roughness Index (IRI)

❖ IRI is used to evaluate the ride quality of the pavement on National Highway System (NHS) and NJDOT Routes. This is in accordance with the American Society of Testing and Materials method E 1926.

❖ **NJDOT IS USING INTERNATIONAL ROUGHNESS INDEX (IRI) TO MEASURE SMOOTHNESS OF PAVEMENT.**

Ride Quality – Why is it important?

- ❖ Many customer surveys, on both a national and local level, have shown us that **Pavement Smoothness** is the number one main factor when it comes to rating the nation's highways.

Ride Quality – Why is it important?

- ❖ Satisfies road users.
- ❖ Decrease in fuel consumption and vehicle maintenance costs.
- ❖ Pavements that are built smoother remain smoother over time and provide a longer service life.
- ❖ Dynamic loadings are lower on smooth pavements = longer lasting pavements.

Specification

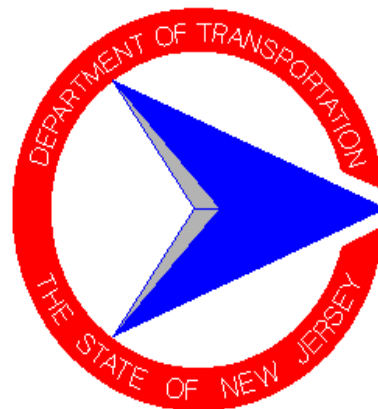


Updated Specifications for Special Provisions for State Aid Projects:

Ride Quality (RQ) Spec:

- ❖ RQ Requirements based on Paving length
- ❖ RQ Requirements for Shoulder and Ramps
- ❖ RQ Requirements for paved Bridge
- ❖ Table for Target IRI Calculation

**State of New Jersey
Department of Transportation**

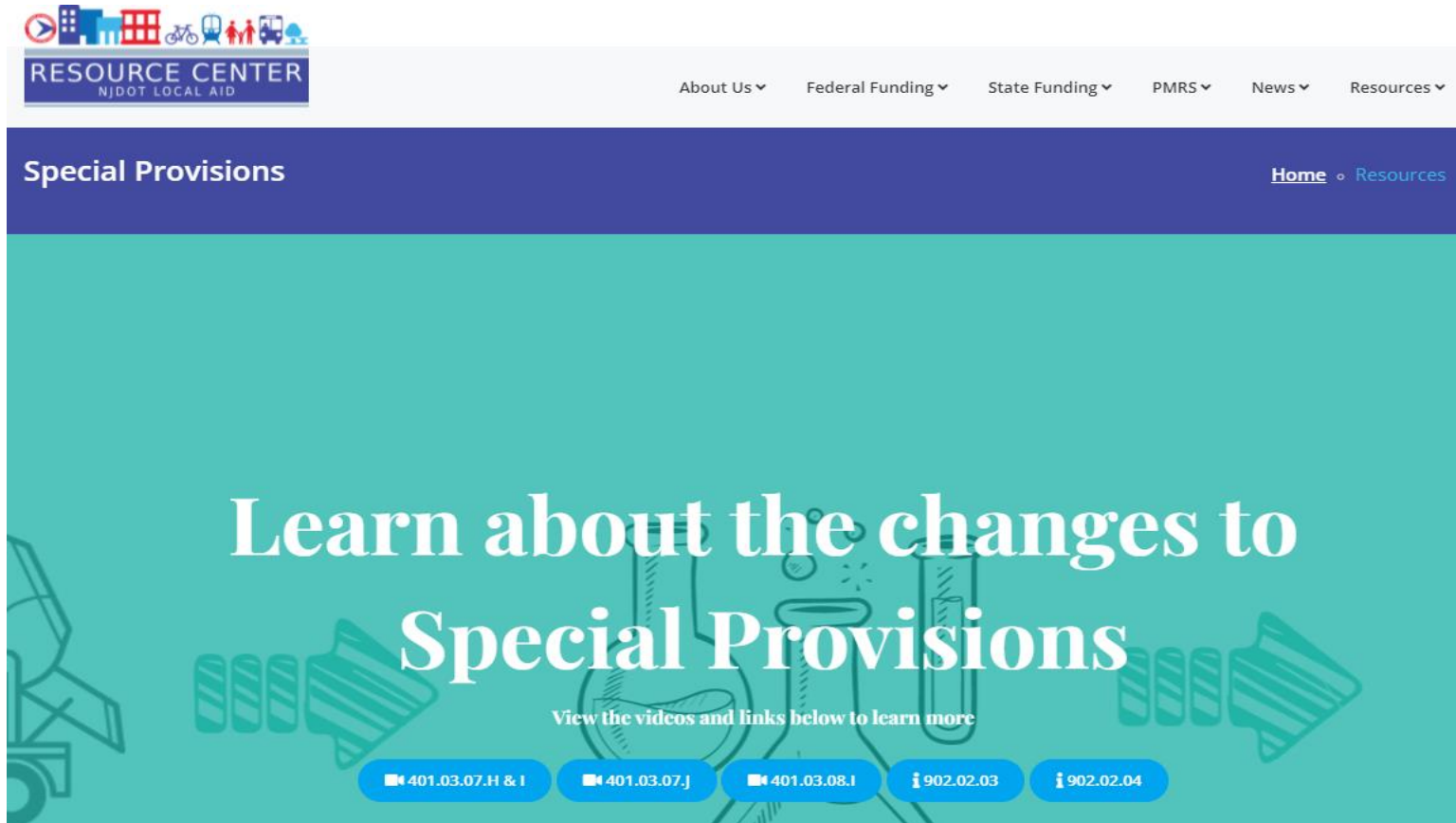


**Special Provisions
For
State Aid Projects**

NJ DOT - Local Aid Resource Center

Website Address:

<https://njdotlocalaidrc.com/special-provisions>



The screenshot displays the NJ DOT Local Aid Resource Center website. The header features a logo with icons for a building, bicycle, train, and people, followed by the text "RESOURCE CENTER NJDOT LOCAL AID". Navigation links include "About Us", "Federal Funding", "State Funding", "PMRS", "News", and "Resources". The main content area has a dark blue header with "Special Provisions" and a breadcrumb trail "Home > Resources". The background is teal with faint line art of a bridge and sound waves. Large white text reads "Learn about the changes to Special Provisions". Below this, a link says "View the videos and links below to learn more". At the bottom, five blue buttons contain the following text: "401.03.07.H & I", "401.03.07.J", "401.03.08.I", "902.02.03", and "902.02.04".

RESOURCE CENTER
NJDOT LOCAL AID

About Us Federal Funding State Funding PMRS News Resources

Special Provisions [Home](#) > [Resources](#)

Learn about the changes to Special Provisions

View the videos and links below to learn more

401.03.07.H & I 401.03.07.J 401.03.08.I 902.02.03 902.02.04

Special Provisions for State Aid Projects- Video 2



401.03.07.J

Hot Mix Asphalt, Ride Quality Requirements

Updated:

Pay Adjustment Equations (PAE) have been updated. PAE factors now include roadway type, existing average International Roughness Index (IRI), the bid price of the last lift of the pavement structure, design thickness, bid price of the milling per square yard, and whether the project is for new construction or reconstruction.

Any Local Aid construction project located on the National Highway System (NHS) or New Jersey State Highways must comply with all ride quality requirements from Pay Adjustment Equations in Table 401.03.07-7 and target IRI from Table 401.03.07-8. (All NHS roadways are listed on the [Department's website](#).) A [pdf list of NHS roadways](#) by standard route ID (SRI) is available.

[IRI Sample Documents](#)

Key Terms in IRI Specification:

❖ Pay Equations

❖ Target IRI

❖ Excluded Lots

Table 401.03.07-7 Pay Adjustment Equations (PAE) for Ride Quality

	Pay Equation Type	Exclusions	Pay Equations	
Mainline	PA1	As shown in the Special Provisions Table 401.03.07-7A	IRI<T	PA1=0 ²
			T≤IRI≤170	PA1=PAE
			IRI>170	PA1= -A or Corrective action
Ramps and Shoulders	PA2	Will include, if tested	IRI ≤ 120	PA2 =0 ²
			120 < IRI ≤ 170	PA2 = (IRI – 120) x (–\$5.00)
			IRI>170	Maximum Negative Pay or Corrective action
Bridge Deck	PA3	Will include, if tested	IRI≤120	PA3=0 ²
			120<IRI≤170	PA3=PAE
			IRI>170	PA3= -A or Corrective action
Local Roadways	PA4	Will include, if tested	IRI ≤ T	PA4=0 ²
			T < IRI ≤ T+80 or 170 whichever is higher	PA4 = (IRI – T) x (–\$1.25)
			IRI>T+80 or 170 whichever is higher	Maximum Negative Pay or Corrective action

RIDE QUALITY PAY ADJUSTMENT EQUATION

$$PAE = \frac{A}{-37.75347 \times \log_e(T) + 194.87} - \frac{A}{-37.75347 \times \log_e(IRI) + 194.87}$$

$$A = 1267.2 \left\{ \frac{M}{9} + \frac{PD}{150} \right\}$$

P= Bid price of last lift of the pavement structure to be evaluated or price listed in table 401.03.07-7B, whichever is higher, per Ton

D= Design thickness of last lift to be evaluated, Inch

M= Bid price of Milling, per Square Yard

T= Target IRI

Target IRI Depends on following Site Specific Factors:

- ❖ **5 Roadway Types**
- ❖ **Current average IRI (C)**
- ❖ **Number of Operations**
- ❖ **Type of Pavement**

Table 401.03.07-8 Target IRI for Resurfacing or Reconstruction (T) ³						
Roadway Type	Current average IRI (C)	New Construction or Reconstruction	Number of Operation for other than New Construction or Reconstruction ⁵			
			One ⁴	Two ⁴	Three ⁴	Four or More ⁴
Target IRI (T)						
NHS & NJDOT Freeways or Limited Access Highways	≤ 60	50	50	50	50	50
	61 to ≤95		53	50	50	50
	96 to ≤170		55	53	50	50
	171 to ≤200		0.64C ⁷	55	53	50
	201 to ≤285			58	55	50
	>286 ⁸			60	58	53
NHS & NJDOT Roadways other than Freeways or Limited Access Highways with speed limit > 35 MPH	≤ 60	60	60	60	60	60
	61 to ≤95		63	60	60	60
	96 to ≤170		66	63	60	60
	171 to ≤200		0.64C ⁷	66	63	60
	201 to ≤285			69	66	60
	>286 ⁸			72	69	63
NHS & NJDOT Roadways other than Freeways or Limited Access Highways with speed limit ≤ 35 MPH	≤ 60	70	70	70	70	70
	61 to ≤95		74	70	70	70
	96 to ≤170		77	74	70	70
	171 to ≤200		0.64C ⁷	77	74	70
	201 to ≤285			81	77	70
	>286 ⁸			84	81	74
Local Roadway with Posted Speed ≥45 MPH	C	80	0.7C or 80 whichever is higher	0.49C or 80 whichever is higher	0.34C or 80 whichever is higher	0.24C or 80 whichever is higher
Local Roadway with Posted Speed <45 MPH	C	100	0.84C or 100 whichever is higher	0.59C or 100 whichever is higher	0.41C or 100 whichever is higher	0.29C or 100 whichever is higher

Current average IRI (C)

❖ **Current average IRI (C) is defined as the preconstruction IRI data measured not more than two years from the start of the project pavement construction.**

Current average IRI (C)

- ❖ Current IRI data for paving routes designated NHS or NJDOT jurisdiction are available at Bureau of “Transportation Data and support”.
- ❖ Current IRI data can be made available by request to Simon Nwachukwu at Simon.Nwachukwu@dot.nj.gov.

Current average IRI (C)

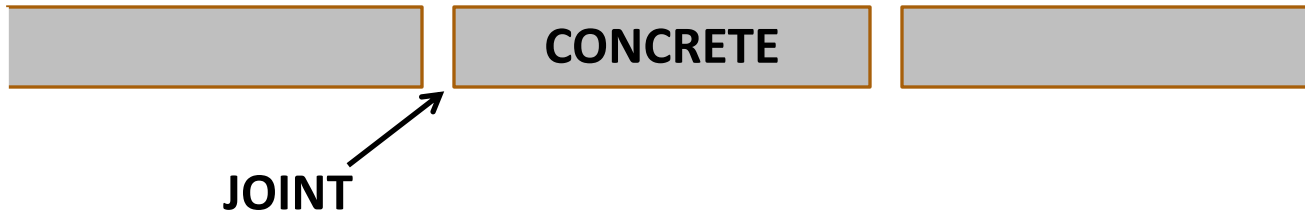
- ❖ If the current average IRI (C) is not available, then the testing agency will test, analyze and report current IRI before pavement construction.

TYPES OF PAVEMENT

FLEXIBLE PAVEMENT

HMA/ASPHALT

CONCRETE PAVEMENT



COMPOSITE PAVEMENT



IRI Exclusions

- ❖ **IMPEDIMENTS (IM)**
- ❖ **SHORT SECTIONS (SS)**
- ❖ **STRUCTURE (SR)**
- ❖ **TRANSVERSE JOINT (TJ)**
- ❖ **RAIL ROAD (RR)**

Examples of RQR Exclusion Calculations:

<https://www.state.nj.us/transportation/eng/pavement/ridequality.shtm>



Department of Transportation

NJDOT  Engineering ▾ Pavement & Drainage Management Technology ▾

Ride Quality Requirements

The New Jersey Department of Transportation (NJDOT) is implementing a ride quality specification that uses profile data collected with inertial profilers for acceptance testing of the final riding surface. The ride specification is applicable for either hot mix asphalt or Portland cement concrete (PCC) pavements and uses the international roughness index (IRI) computed from profile measurements to quantify the level of ride quality achieved from construction.

Ride Quality Requirements (RQR) Software

To assist designers in developing ride quality requirements for NJDOT projects, below is the link to download Ride Quality Requirements (RQR) software. The RQR is a Microsoft Excel work book containing various macros to automate production of required pay equations and exclusions for ride quality specifications. Make sure macro is enabled when the spreadsheet is opened and the file is saved with an .XSLM extension.

- [RQR Software](#) (zip 2.3m - macro enabled excel file)
 - [Examples](#) (pdf 69k)
 - [Example RQR Exclusion Calculation](#)
 - [Guidelines for RQR Software](#)
- [PA Estimator](#) (xls 1.6m)

RQR Software:


Measurements Miles (Mi) or Feet (Ft)

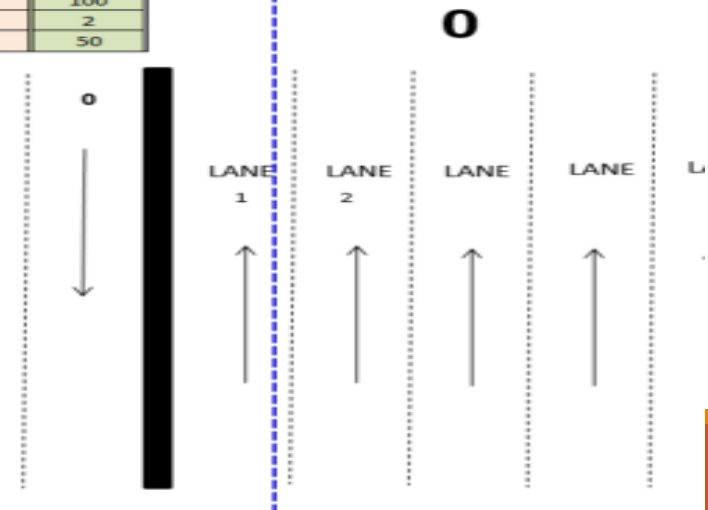
Measurements in: **FT**

Do not use "+" sign for Station. For example- 203+50 , input 20350.

[illegible]

Localized Factor Summary					
Exclusion (Ft)	104	50	200	100	100
# of Occurrence	2	1	2	1	2
Average Exclusion (Ft.)	52	50	100	100	50

Exclusion Distribution in Lanes						
	Lane 	1	2			
TJ	Exclusion (FT)	52	52	0	0	0
	# of Occurrence	1	1	0	0	0
	# of Lots	1	1	-	-	0
IM	Exclusion (FT)	50	0	0	0	0
	# of Occurrence	1	0	0	0	0
	# of Lots	1	0	-	-	-
SR	Exclusion (FT)	100	100	0	0	0
	# of Occurrence	1	1	0	0	0
	# of Lots	2	2	-	-	-
SS	Exclusion (FT)	0	100	0	0	0
	# of Occurrence	0	1	0	0	0
	# of Lots	0	2	-	-	-
RR	Exclusion (FT)	50	50	0	0	0
	# of Occurrence	1	1	0	0	0
	# of Lots	1	1	-	-	-
TOTAL	# of Lots	5	6			



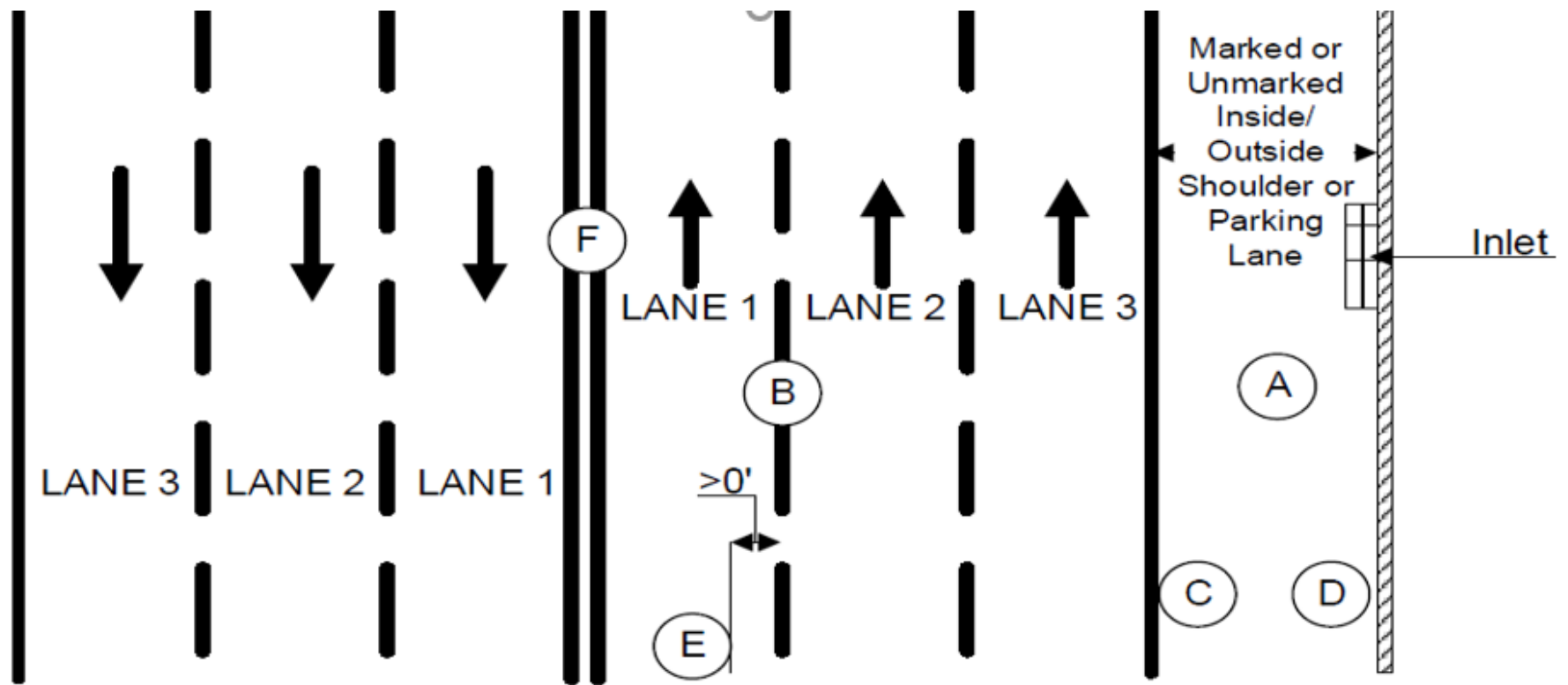


Figure-1

IMPEDIMENTS

- Count Impediment "B" in "Lane 1" & "Lane 2".
- Count Impediment "E" in "Lane 1".
- Count Impediment "F" in "Lane 1" in both direction.

If Marked or Unmarked Inside/Outer Shoulder $\leq 6'$

- Count Impediment "A, C, & D" and "Inlet" in "Lane 3".

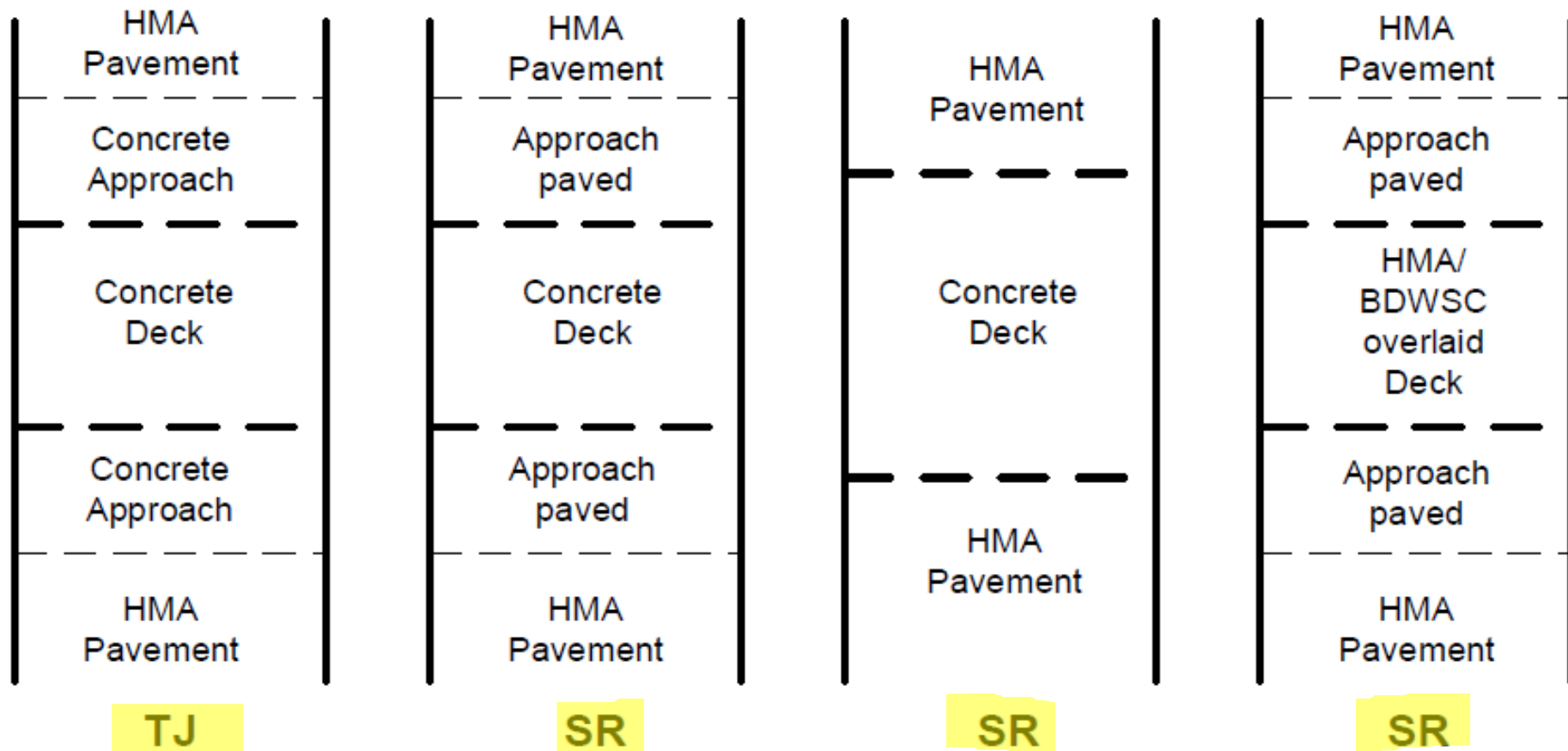


Figure 7

EXCLUSION CALCULATION FOR BRIDGE STRUCTURES

1. If Approach is **NOT** paved, count as **TJ**.
2. For all other conditions, count as **SR**.



Figure 5

RAILROAD (RR)

- Enter as RR which is equivalent to one TJ.

401.03.07 HMA Courses

J. Ride Quality Requirements.

Table 401.03.07-7A Exclusions for Resurfacing or Reconstruction

Roadway	Lane Number	Exclusions
Route X EB MP 0.50–5.25	1	36
Route X EB MP 0.50–5.25	2	11
Route X EB MP 0.50–5.25	3	15
Route X EB MP 3.89–4.39	4	1
Route X WB MP 0.50–5.53	1	36
Route X WB MP 0.50–5.53	2	11
Route X WB MP 0.52–5.53	3	15
Route X WB MP 4.00–5.53	4	2

QA Testing



RIDE QUALITY TESTING (QA)

- ❖ Pavement Smoothness will be measured by Testing the longitudinal profile of the final riding surface with a class 1 inertial profiling system according to the NJDOT R1.
- ❖ If project conditions do not allow for the use of that system, class 1 walking profiler or light weight profiler can be used.

RIDE QUALITY TESTING (QA)

- ❖ To prepare for IRI testing, NOTIFY the municipality's or county's field representative **AFTER paving the final riding surface of the project.**
- ❖ The field representative will request testing to individual testing agency.

RIDE QUALITY TESTING (QA)

- ❖ Mechanically sweep the surface before testing.
- ❖ Prepare the pavement to facilitate auto triggering on laser profiler.
- ❖ Place a single line of temporary marking tape perpendicular to the roadway base line at the beginning and end of each lane, shoulder and ramp to be tested or as directed by the testing agency.

RIDE QUALITY TESTING (QA)

-
- ❖ Submit the actual stationing of each temporary marking locations to the field representative.
 - ❖ All bridge decks, etc. within the requested IRI testing limits.
 - ❖ Beginning and end mile post limits of bridge decks.
 - ❖ Any excluded section
 - ❖ PARTIAL LANE TEST REQUEST is not accepted.

Construction

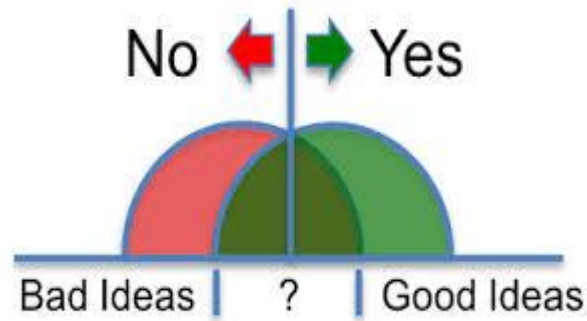


How user measures the quality of completed pavement work when driving on the new pavement?

- a) Sufficient pavement structure
- b) Use of PREMIUM-mixes
- c) Total cost of construction
- d) Smooth ride



Should we accept waiver for Ride Quality?



Should we allow the contractor to pave 4 feet wide shoulder as a separate paving operation from mainline?



Ride Quality vs. Longitudinal Joints

❖ Shoulder < 6 feet

Avoid longitudinal joint along the shoulder

COMMON CONTRACTOR REQUESTS FOR WAIVER OF RQ

Change of plan

- ❖ Involve Pavement Design Unit to ensure that Change of plan impact Ride Quality Requirements.
- ❖ Ensure contractor understand Ride Quality Requirements expected after Change of Plan.

COMMON CONTRACTOR REQUESTS FOR WAIVER OF RQ

HMA repair quantity or full depth repairs quantity (if and where directed) is changed.

- No impact on Ride Quality
- Repairs are performed to improve structurally failed areas.
- Target IRI calculation considers structurally failed area
- Any change in if and where directed quantity will not trigger change in the target IRI.

Ride Quality - TRUTH

- ❖ IRI targets are achievable.
- ❖ Existing IRI and pavement type have very minor effect on achieving target IRI
- ❖ Paving practices have major effect on final IRI
 - ❖ Coordination of entire paving operation is key
 - ❖ Properly using equipment
 - ❖ Rolling and milling pattern

CONSTRUCTION

Following information will help us during claims process:

- **Document!!**
- **Milling Machine- speed, visual assessment of the quality of milled surface – good texture and cleaned properly**
- **Paver (Is the operation smooth and continuous ?)–**
 - **Speed, Stop and reason for stop**
 - **Constant flow of HMA Trucks**
 - **Rollers keeping up with paver**

HMA temperature behind paver

HMA TRUCKS SUFFICIENT

Number of rollers, Roller parking on New Mat

- **QC performed by contractor, if any**

Conclusion

❖ IRI specification is so important.

THANK YOU

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